SPECTROSCOPIC NOTES*

On the Construction, Arrangement, and best Proportions of the Instrument with reference to its efficiency.

THE spectroscope consists essentially of three parts—a prism, or train of prisms, to disperse the light; a collimator, as it is called, whose office is to throw upon the prisms a beam of parallel rays coming from a narrow slit; and a telescope for viewing the spectrum formed by the prisms.

Supposing the slit to be illuminated by strictly homogeneous light, the rays proceeding from it are first rendered parallel by the object-glass of the collimator, are then deflected by the prisms and finally received upon the object-glass of the view-telescope, which, if the focal lengths of the collimator and telescope object-glasses are the same, forms at the focus a real image of the slit, its precise counterpart in every respect except that it is somewhat weakened by loss of light and slightly curved.†

If the focal length of the view-telescope is greater or less than that of the collimator, the size of the image is proportionally increased or diminished.

This image is viewed and magnified by the eye-piece of the telescope.

If now the light with which the slit is illuminated be composite, each kind of rays of different refrangibility will be differently reflected by the prisms, and form in the focus of the telescope its own image of the slit. The series of these images ranged side by side in the order of their colour constitutes the spectrum, which can be perfectly pure only when the slit is infinitely narrow (so that the successive images may not overlap), and accurately in the focus of the object-glass of the collimator, which object-glass, as well as that of the telescope, must be without aberration either chromatic or spherical, and the prisms must be perfectly homogeneous and their surfaces truly plane.

Of course, none of the conditions can be strictly fulfilled. An infinitely narrow slit would give only an infinitely faint spectrum; and no prisms or object-glasses are absolutely free from faults. A reasonably close approximation to the necessary conditions can, however, be obtained by careful workmanship and adjustment, and it becomes an important subject of inquiry how to adapt the different parts of the instrument to each other so as to secure the best effect, and how to test separately their excellence, in order to trace and remedy as far as possible all faults of performance.

With reference to the battery of prisms, several questions at once suggest themselves relative to the best angle and material, the number to be used, the methods of testing their surfaces and homogeneity, and the most effective manner of arranging them.

Angle and Material of the Prisms.—As to the refracting angle, the careful investigation of Prof. Pickering, published in the *American Journal of Science and Art* for May 1868, puts it beyond question that with the glass ordinarily employed an angle of about 60° is the best. For instruments of many prisms there is an advantage as regards the amount of light in making the angle such that the transmitted ray at each surface shall be exactly perpendicular to the reflected. For ordinary glass, the refracting angle determined by this condition somewhat exceeds 60°; for the so-called "extra-dense" flint it is a little less.

The high dispersive power of this "extra-dense" glass is certainly a great recommendation. But it is very yellow, powerfully absorbing the rays belonging to the upper portion of the spectrum, and is very seldom homogeneous. It is so soft also, and so liable to scratch and tarnish, that it can only be safely used by casing it with some harder and more permanent glass, as in the compound prisms of Mr. Grubb, and the direct vision prisms of many makers.

For many purposes these direct vision prisms are very convenient and useful, but they are hardly admissible in instruments of high dispersive power designed to secure accurate definition of the whole spectrum, the violet as well as the yellow.

Test for Flatness of Surface.—For testing the flatness of the prism surfaces, probably the best method is to focus a small telescope carefully upon some distant object (by preference the moon or some bright star), and then to scrutinise the image of the same object formed by reflection from the surface to be tested. Any general convexity or concavity will be indicated by a corresponding change of focus required in the telescope; any irregularity of form will produce indistinctness, and by using a cardboard screen perforated with a small orifice of perhaps $\frac{1}{4}$ inch in diameter, the surface can be examined little by little, and the faulty spot precisely determined.

Test for Homogeneity.—It is not quite so easy to test the homogeneity of the glass. Any strong veins may, of course, be seen by holding the prism in the light, and if the ends of the prism are polished, the test by polarised light will be found very effective in bringing out any irregularities of density and elasticity in the glass. A blackened plate of window glass serves as the polariser; a Nicol's prism is held in one hand before the eye in such a position as to cut off the reflected ray, and with the other hand the glass to be tried is held between the Nicol and the polariser. If perfectly good it produces no effect whatever; if not it will show more or less light, usually in streaks and patches.

On the whole, however, the method of testing which has been found most delicate and satisfactory is the following:—

A Geissler tube containing rarefied hydrogen is set up vertically, and illuminated by a small induction coil.

A small and very perfect telescope of about six inches focus is directed upon it from a distance of seventy-five or one hundred feet, and carefully adjusted for distinct vision.

The prism to be tested is then placed in front of the object-glass of the telescope with its refracting edge vertical, adjusted approximately to the position of minimum deviation, and telescope and prism together then turned (by moving the table on which they stand), until the spectrum of the tube appears in the field of view. This spectrum consists mainly, as is well known, of three well-defined images of the tube, of which the *red* image, corresponding to the C line, is the brightest and best defined, and stands out upon a nearly black background.

Supposing then the *flatness* of the prism surfaces to have been previously tested and approved, the goodness of the glass may be judged of by the appearance and behaviour of this red image; and by using a perforated screen in the manner before described, inequalities of optical density are easily detected and located. Irregularities, which would hardly be worth noticing in a telescope object-glass, where the total deviation produced by the refraction of the rays is so small, are fatal to definition in a spectroscope, especially one of many prisms, and it is very difficult to find glass which will bear the above-named test without flinching. Of course it must be conducted at night, or in a darkened room.

Number and Arrangement of Prisms.—The number of prisms to be employed will depend upon circumstances. If the spectrum to be examined be faint, and either continuous or marked with dark lines, or by diffuse bands, either bright or dark, we are limited to a train of few prisms.

The light of the sun is so brilliant that, in studying its spectrum, we may use as many as we please. The light is abundant after passing through 13, and I presume would still be so if the train were doubled.

Spectra of fine well-defined *bright lines* also bear a surprising number of prisms. The loss of light arising from the transmission through many surfaces is nearly, if not quite, counterbalanced by the increased blackness of the background, and the greater width of slit which can be used.

As to the best arrangement for the prisms, this also must be determined by circumstances.

Where exact measurements are aimed at, as, for instance, for the purpose of ascertaining the wave-length of lines, or the dispersion co-efficient of a transparent medium, the prism or prisms ought to be firmly secured in a positive and determinable relation to the collimator. A train of many prisms can hardly be safely used in such work on account of the difficulty in obtaining this necessary fixity, and if high dispersion is indispensable, it can only be obtained by enlarging the apparatus.

But for most purposes it is better that the prisms, instead of being fixed, should be mounted upon some plan which will secure their automatic adjustment to the position of minimum deviation.

Having now thoroughly tried the plan which I proposed and published in this Journal last November, I am prepared to say that I cannot imagine anything more effective and convenient.

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† The curvature arises from the fact that the rays from the extremities of the slit, though nearly parallel to each other, make an appreciable angle with those which come from the centre. They therefore strike the surface of the prisms under different conditions from the central rays, and are differently refracted, usually more. The higher the dispersive power of the instrument and the shorter the focal length of the collimator, the greater this distortion, which is also accompanied by a slight indistinctness at the edges of the spectrum.

The arrangement of Mr. Browning and its extension by Mr. Proctor, are equally effective so far as the adjustment of the prisms is concerned, but are less compact and simple, and do not afford the same facility in changing the number of prisms in use.

In my instrument the light, after leaving the collimator, falls perpendicularly upon the face of a half-prism, passes through the train of prisms near their bases; at the end of the train is twice totally reflected by a rectangular prism attached to the last of the train (which is also a half prism), is thus transferred to the upper story of the train, so to speak, and returns to the view-telescope, which is firmly attached to the same mounting as the collimator and directly above it. Both are immovable, and the different portions of the spectrum are brought into view by means of the screw, which acts upon the last prism, and through it upon the whole train. The adjustment for focus is by a milled head, which carries the object-glasses of both collimator and telescope in or out together. Since they have the same focal length, this secures the accurate parallelism of the rays as they traverse the prisms.

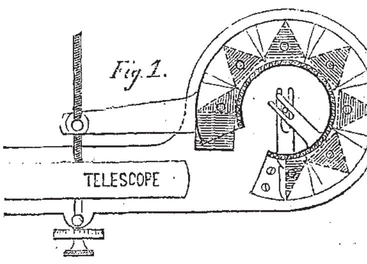
Fig. 1.

The annexed diagram, taken from the paper already alluded to,* exhibits the plan of the arrangement, and requires no explanation, unless to add that, to avoid complication in the figure, I have represented only two of the radial forks which maintain the prisms in adjustment; also, that the prisms are connected to each other at top and bottom, not by hinges, but by flat springs, preventing all shake.

By adding another tier of prisms and sending the light back and forth through a third and fourth story, the dispersion can be easily doubled with very small additional expense, except for the prisms themselves; the mechanical arrangements remaining precisely the same.

I desire, in this connection, to call attention to the great advantages gained by the use of the half prism at the commencement of the train, a point which hitherto seems to have escaped notice.

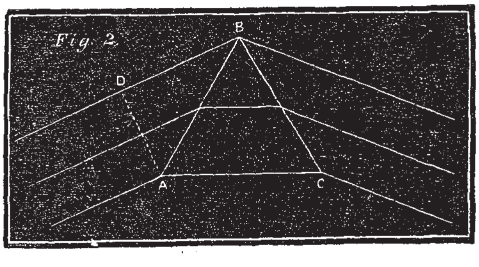
Fig. 2.

With a prism of 60°, having a mean refractive index, μ, 1·6, and placed in its best position, the course of the rays is as shown in Fig. 2. The side *a b* is just $1\frac{2}{3}$ times the cross section, *a d*, of the transmitted beam. In other words a prism of the same material and angle described, in order to transmit a beam one inch in diameter, must be one inch high and have sides $1\frac{2}{3}$ inches long.

But when the light is received perpendicularly upon the face of a half prism, as in Fig. 3, then, since $bc = be \div \cos 30°$, the length of the prism side, *b c*, requires to be only 1·155 times as great as the diameter of the transmitted beam.

Thus a train of prisms each 1 inch high, and having the sides of their triangular bases each 1·155 inches long, led by an initial half prism in the way indicated, would transmit a beam 1 inch in diameter, while without the initial half prism the sides would have to be 1·667 long, the surface to be worked and polished would be 1·44 (*i e.* 1·667 ÷ 1·155) times as great, and the quantity of glass required 2·08 (*i.e.* $1{\cdot}44^2$) times as great. With a higher index of refraction the gain is still greater.

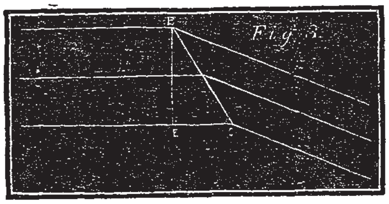
Fig. 3.

This advantage of course is not obtained without losing the dispersive power of one half prism. But where the train is extensive this loss is comparatively insignificant, and may be made up by a slight increase of the refracting angles. Indeed, in an instrument of the form above described, it is necessary, if the train is led by a *whole* prism, to reduce the refracting angle from 60° to about 55°, in order that the reflecting prism at the end of the train may not interfere with the collimator, while with the initial half prism the full angle of 60° can be used, so that in this case there is practically no loss whatever.

It would seem to deserve consideration, whether in the construction of spectroscopes to be used with some of the huge telescopes now building, it may not be advisable to carry the principle still further, by employing *two* or more half prisms at the beginning of the train in order to economise material and weight.

Dispersive Efficiency.—The dispersive efficiency of the spectroscope is its ability to separate and distinguish spectral lines whose indices of refraction differ but slightly; it is closely analogous to the *dividing power* of a telescope in dealing with double stars. It depends* not only upon the train of prisms, but also upon the focal lengths of the telescope and collimator, the width of the slit, and the magnifying power of the eye-piece.

As has been said before, each bright line is an image of the slit whose *magnitude*, referred to the limit of distinct vision, depends upon the telescope and collimator, but is independent of the prism train. The *distance* between the centres of two neighbouring lines, on the other hand, depends upon the number and character of the prisms, the focal length of the telescope, and the magnifying power of its eye-piece, but is totally independent of the collimator.

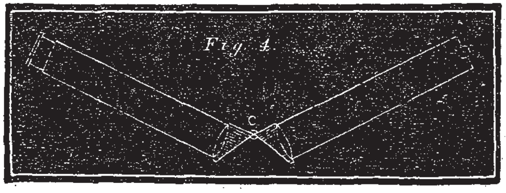
Fig. 4.

In order that two lines may be divided, it is necessary that the *edges* of their spectral images should be separated by a certain small distance—a *minimum visibile*, whose precise value is of no particular importance to our present purpose, but which I suppose to be about $\frac{1}{500}$ of an inch.

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* After the appearance of the article referred to, I found that Mr. Lockyer had anticipated me by some months, not only in respect to the method of making the rays traverse the prism train twice, but also in the use of a half prism at the beginning of the train, and the employment of an elastic spring in the adjustment for minimum deviation. In all essential particulars his instrument is the same as mine, though in some matters of detail there are differences which have proved to be of practical importance in favour of my own.

Mr. Lockyer has, however, never printed an account of his instrument, and at the time of my publication I knew only the fact (which I then mentioned), that he intended to send the light twice through the prism train by a total reflection.

The beautiful instrument recently constructed for Dr. Huggins by Mr. Grubb differs mainly in using compound prisms, and in producing the adjustment for minimum deviation by an arrangement of link work, which, though not theoretically exact, is practically accurate.

* It is very common to describe the dispersive power of a spectroscope as being equivalent to a certain number of prisms, or a certain number of degrees from A to H. But either method fails entirely to convey an idea of the appearance of the spectrum in the instrument, and it is much better to name the closest double line which it will divide, or else to give the distance between the two D lines, either linear (referred of course to the limit of distinct vision), or angular. If we know, for example, that the D lines are separated 1′, or, what comes to the same thing, appear to be one-sixth of an inch apart, we have a definite idea of the power of the instrument.

From these principles it is easy to deduce a formula which will express the dispersive efficiency of a given instrument, and enable us to judge of the effect of variations in the proportion and arrangement of the parts.

Let f be the focal length of the collimator.

f^1 ,, ,, ,, telescope.

m the magnifying power of the eye-piece (which is found by dividing the limit of distinct vision by the equivalent focal length of the eye-piece and adding unity to the quotient).

n the number of prisms in the train.

w the width of the slit.

k the *minimum visibile* above alluded to.

$d\,\mu$, the difference between the indices of refraction for two adjacent lines; and finally

δ, the co-efficient of dispersion for each prism (which, r being the refracting angle of the prism, is given by the equation

$$\delta = \frac{\sin \frac{1}{2} r}{\sqrt{1 - \mu^2 \sin^2 \frac{1}{2} r}} \Bigg)$$

If, now, we put D for the distance between the centres of the two lines, and b for their breadth, we shall have

$$D = m\,n\,s\,\delta\,f^1.\,d\,\mu, \text{ and}$$
$$b = m\,w\,f^1 \div f.$$

But the distance between the edges of the lines equals $D - b$; and this, for two lines as close as the instrument will divide, must equal k.

Hence $k = m\,n\,\delta\,f^1.\,d\,\mu - \frac{m\,w\,f^1}{f}$. Finding from this the value of $d\,\mu$, taking its reciprocal as a measure of the dispersive efficiency of the instrument, and calling it E, we get

$$E = m\,n\,\delta\,\frac{f f^1}{k f + m w f^1} \qquad (1)$$

This formula, in which m, n, and δ appear as simple factors, of course supposes that the perfection of workmanship and intensity of the light are such that there is no limit to the magnifying power and number of prisms which may be employed.

My special object, however, in working it out has been to exhibit clearly what is evident from its last term, the dependence of the dispersive efficiency upon the focal lengths of collimator and telescope.

Differentiating equation (1) with respect to f and f^1, we obtain

$$d\,E = m.\,n.\,\delta\,\left\{\frac{k f^2 (d f^1) + m w f^1 (d f)}{(k f + m w f^1)^2}\right\} \qquad (2)$$

which shows that any increase in either f or f^1 adds to the dispersion. If f increases, both D and b increase in the same proportion, and so, of course, does the width of the interval between the adjacent lines; while every augmentation of f^1 decreases the width of the spectral images without in the least affecting the distance between their centres.

This principle seems to have been often overlooked, and collimators and telescopes of short focus employed when longer ones would have been far better.

In spectroscopes designed to be used for astronomical purposes, at the principal focus of a telescope, there is, of course, no advantage in making the angle of aperture of the collimator much greater than that of the equatorial itself; accordingly a collimator of one inch aperture ought to have a focal length of 10 or 12 inches, or, if special reasons determine a focal length of only 6 inches, then it is needless to make the collimator and view telescope much over half an inch in diameter, and the prisms may be correspondingly small.

If, on the other hand, the focus of telescope or collimator is lengthened for the purpose of securing increased dispersion, object glasses and prisms must also be correspondingly enlarged, in order to transmit the same amount of light.

It is, perhaps, worth noting that when f and f^1 are equal, formula (1) becomes simply

$$E = \frac{m.\,n.\,\delta.\,f}{k + m w}. \qquad (3)$$

Luminous Efficiency.—The extreme faintness of many spectra greatly embarrasses their study, so that it becomes a matter of interest to examine how the different dimensions and proportions of a given instrument stand related to the brightness of the spectrum produced.

It appears to be necessary, for this purpose, to distinguish two classes of spectra, those composed of narrow and well defined *bright lines*, and those which are not, the light being spread out more or less evenly and continuously.

The brightness of a spectrum of the latter kind is evidently directly proportional to the amount of light admitted, diminished by its subsequent losses, and inversely to the area over which it is distributed; similar considerations apply in the first case, only as the lines are exceedingly narrow images of the slit, their brightness, being independent of their distance from each other, is inversely proportional to the length of the lines simply—*i.e.*, to the *width* of the spectrum, having nothing to do with its *length.*

Using the same notation as before, merely adding

i = intensity of source of light.

l = length of the slit.

a = linear aperture of the collimator object glass;

and supposing the prisms and view telescope of a size to take in the whole beam transmitted by the collimator, and that the angular magnitude of the luminous object, as seen from the slit, is sufficient to furnish a pencil large enough to fill the collimator object glass, we shall then have for the quantity of light transmitted to the prisms the expression

$$i\,l\,w\,\frac{a^2}{f^2}.$$

This is afterwards diminished in passing through the prism train and telescope.

To estimate the precise amount of this loss is very difficult, and the algebraic expression for it is of so complicated a character that it would be of little use to attempt to introduce it into our formula. Calling it S, however (which of course is a function of the number and refracting angle of the prisms, as well as of the optical character of the glass), we may write for the quantity of light effective in forming the spectrum,

$Q = i\,l\,w\,\frac{a^2}{f^2} - S$. And this expression applies to both kinds of spectra—bright line and continuous.

In the continuous spectrum this light is spread out over an area whose length is the angular dispersion of the train * $\triangle$, multiplied by the magnifying power of the eye-piece and by the focal length of the view telescope, and whose breadth is the width of the spectrum. Putting A for this area, we have

$$A = \frac{l\,m^2\,n.\,\triangle.\,f_1{}^2}{f}.$$

And for the intensity of light in the continuous spectrum, which equals $Q \div A$, we get finally

$$L = \frac{i\,l\,w\,a^2 - f^2\,S}{l\,m^2\,n\,\triangle\,f_1{}^2 f}. \qquad (4)$$

If we neglect the loss of light in transmission, and take $f = f^1$, the formula simplifies itself to

$$L^1 = \frac{i\,w\,a^2}{m^2\,n\,\triangle\,f}3. \qquad (5)$$

Either of these formulæ shows how rapidly the light is cut down by any increase of the dispersive power, whether by adding to the prism train or by enlargement of the linear dimensions of the apparatus.

Our only resource in dealing with spectra of this kind, when the limit of visibility on account of faintness is nearly attained, seems to be either to increase i or a. If the luminous object be a point (like a star) we can do the former by concentrating its light on the slit with a lens; if it be diffuse, like the light of the sky, I know no means for producing the desired concentration, and we can only gain our end by increasing the angular aperture of the collimator.

For the discontinuous bright-line spectrum, the case is quite different. Q, *i.e.* the quantity of light which goes to form the spectrum, remains unchanged, but instead of A the whole area covered by the spectrum we have only to consider its width, *i.e.* the length of the lines.†

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* $\triangle = n\left(\text{Sin}^{-1}(\mu_H \times \text{Sin}\,\frac{1}{2}\,r) - \text{Sin}^{-1}(\mu_A\ \text{Sin}\,\frac{1}{2}\,r)\right)$ where μ_A and μ_H are respectively the indices of refraction for the lines A and H; the prisms being supposed to be so mounted as to maintain the position of minimum deviation.

† So long as the opening of the slit is small enough to secure accurate definition of the lines, it is not necessary to take into account either this or the magnifying power as diminishing the brightness of the lines by increasing their breadth, since irradiation alone gives them a sensible width sufficient to render the effect of other causes comparatively unimportant.

We then have $A^1 = \frac{lmf^1}{f}$;

and for the brilliance of the bright line spectrum, we get

$$\Lambda = \frac{Q}{A'} = \frac{ilwa^2 - f^2 S}{lmff^1} \qquad (6)$$

If we neglect S, the loss of light in transmission through the apparatus, and suppose $f = f^1$, this becomes

$$\Lambda' = \frac{iwa}{mf^2} \qquad (7)$$

These formulæ show that with a spectrum of this kind we may, without diminishing the brightness of the lines, increase the dispersive power of our instrument to any extent by increasing its linear dimensions; if we increase the dispersive power by adding to the prism train, the case is different, since *S* is a function of *n*, the number of prisms.

New form of Spectroscope.—I close the article with the suggestion of a new form for a chemical spectroscope, which seems to present some advantages in the saving of material and labour as well as of light.

The figure (Fig. 4) sufficiently illustrates it, except that it may be necessary to add that I have not represented any of the many possible convenient arrangements for reading off the positions of lines observed. The centre of motion for the telescope is at *c*, the collimator remaining fixed.

The half prisms of heavy flint-glass are concave at the rear surface, and directly cemented to the single crown glass lenses, which form the object-glasses of telescope and collimator. There is thus a saving of two surfaces over the common form; and, what is more important, the prisms to fit telescopes of a given aperture are considerably smaller on the face, and can be made from plates of glass of less than half the thickness required by the ordinary construction, a circumstance which greatly reduces the difficulty of obtaining suitable material.

NOTES

We learn by British-Indian cable that the English Government Eclipse Expedition arrived at Galle on Monday last; all well. The authorities in India and in Ceylon are doing everything they can to assist the party. M. Janssen has gone to the Neilgherries. Mr. Lockyer is in communication with Colonel Tennant. The weather was at that time fine.

Professor John Young has written to the *North British Daily Mail*, detailing the reasons for the notice of motion which he gave in April last to the General Council of the University of Glasgow, relative to the division of the chair of Natural History in that University. The duties of the chair would render it incumbent on its occupant to teach, if required to do so, Zoology, Comparative Anatomy and Physiology, Geology and Palæontology, Mineralogy, Mining, Metallurgy, and possibly Meteorology. Actually, Professor Young gives instruction in Comparative Anatomy and Geology. He is naturally extremely anxious that he should no longer be called upon to teach subjects which, in the present state of science, it is impossible can be efficiently combined. It is to be hoped that, before long, the University will see the necessity of instituting a separate chair of Geology, as has recently been done at Edinburgh; but where will be found a Sir Roderick Murchison to endow it in so munificent a manner?

At the second M.B. Examination for Honours at the University of London, Mr. William Henry Allchin, of University College, has taken the Scholarship and gold medal, and Mr. Henry Edward Southee, of Guy's Hospital, the gold medal in Medicine; Mr. Richard Clement Lucas, of Guy's Hospital, the gold medal in Obstetric Medicine, and Mr. Ernest Alfred Elkington, of the General Hospital, Birmingham, the gold medal in Forensic Medicine. At the second B.A. and second B.Sc. Examination, Mr. Thomas Olver Harding, of Trinity College, Cambridge, obtained the Scholarship in Mathematics and Natural Philosophy. No gold medals were awarded in Animal Physiology, Chemistry, Geology and Palæontology, or Zoology.

Mr. Lazarus Fletcher, of the Manchester Grammar School, was on Saturday last elected to the vacant scholarship at Balliol College, on the foundation of Miss H. Brakenbury, for the encouragement of the study of Natural Science. Mr. Hainsworth, of the same school, and Mr. Greswell, of Louth School, were also mentioned by the examiners as worthy of commendation. The scholarship is worth 70*l.* a year, and is tenable for three years.

With reference to the destruction of the Museum at Chicago, we learn that Dr. Stimpson's own collection of North American shells formed part of the Smithsonian Museum; and that the collection made by Professor Agassiz and Count Pourtales, in their deep-sea explorations of the Gulf of Mexico, belonged to the Cambridge Museum. Many of Dr. Stimpson's MSS. and drawings have been published. Mr. Gwyn Jeffreys was, as our readers are aware, fortunately the means of saving some of the shells from the Gulf of Mexico, which he is now engaged in working out before returning. Many valuable specimens which Mr. Jeffreys took to Chicago of course shared the fate of the remainder; some of them, however, he hopes to be able to replace. Professor Agassiz has offered Dr. Stimpson a place at Cambridge, Mass., and to give him the means of again carrying on dredging operations in the Gulf of Mexico.

A fine young pair of the Grey seal (*Halichœrus grypus*) has just been added to the Zoological Society's living collection. This species, although not uncommon on some parts of the British coast, has never previously been received alive by the Society. The present specimens were obtained near St. David's in South Wales, where this seal is said to be of not unfrequent occurrence. Besides this seal, the Society's collection also contains examples of three other Phocidæ—namely, the sea-lion (*Otaria jubata*), the Cape eared seal (*Otaria pusilla*), and the common seal (*Phoca vitulina*).

In the Northern United States the richest marine fauna is to be found in the vicinity of Eastport, Maine, the adjacent region of the Bay of Fundy having become classic ground through the labours of Stimpson, Verrill, Packard, Morse, Webster, Hyatt, &c. It is rumoured, according to *Harper's Weekly*, that Mr. J. E. Gavit, of New York, president of the American Bank-note Company, and at the same time an eminent microscopist, has it in contemplation with some friends to erect a building at Eastport, to be suitably endowed and maintained for the use of any naturalists who may wish to avail themselves of the facilities it may afford. We can only hope that so excellent an idea may be realised at an early day.

The latest advices from Captain Hall's expedition were dated at Upernavik, September 5, being somewhat later than the information brought back by the *Congress*. After parting with the *Congress* at Disco, Captain Hall sailed nearly north until he reached the harbour of Proven, where he landed and endeavoured to obtain dogs. In this, however, he was not very successful, procuring only eighteen, most of which were not well fitted for service. From Proven the *Polaris* proceeded to Upernavik, arriving there on the 30th of August. He left that port on the 5th of September, and continued on his polar journey.

Among the movements of naturalists abroad, we understand that Mr. J. Matthew Jones, F.L.S., President of the Nova Scotian Institute of Natural Science, intends spending the winter months in the Bermudas, for the purpose of more thoroughly investigating the marine zoology of the group.

Messrs. Westermann, of Brunswick, announce for early